- *Water Quality Modeling Plan.* Partial Consent Decree Deliverable. Submitted to PA-DEP July 27, 2015.
- *Sensitive Areas/Priority Areas in the Harrisburg Receiving Waters.* Partial Consent Decree Deliverable. Submitted to PA-DEP April 1, 2016.
- *PADEP Susquehanna River Bacteria Sampling Report.* Sent to Capital Region Water August 1, 2016.
- *2016 Draft Pennsylvania Integrated Water Quality Monitoring and Assessment Report.* DEP

4.6.4 Receiving Water Quality Studies and Characteristics

Over the past 10 years, periodic water quality monitoring and analysis has been conducted on the two waterbodies receiving direct discharges from CRW's CSOs, the Susquehanna River and Paxton Creek. This data has been collected by CRW (for preparation of the 2005 LTCP), US-EPA (for preparation of the 2008 Paxton Creek TMDL), and by PA-DEP / Susquehanna River Basin Commission (via the relatively long-term Water Quality Network and over the past three years as part of the Susquehanna River Study).

A review of existing water quality data is documented in the PCD deliverable *LTCP Approach* submitted to PA-DEP on December 23, 2014. The review presents data from monitoring, over the past decade or more, within the reaches of the Susquehanna River and Paxton Creek receiving discharges from CRW's combined sewer system. The document summarizes pertinent available data and published conclusions drawn from these data regarding CSO discharge characteristics, water quality, physical stream assessments, and biomonitoring for the Susquehanna River and Paxton Creek. Further documentation of completed water quality sampling activities, and the data that were obtained, was documented in Section 4 of the March 2017 *Combined Sewer System Characterization Report.* [17]

4.6.4.1 Susquehanna River Sampling and Studies

As part of the development of the 2005 LTCP, CSO discharges were monitored in 2003. Samples of CSO discharges were collected throughout overflow events to determine the combined sewer wastewater characteristics. Three CSO events between June and November 2003 were sampled at eight discharge locations selected based on estimated overflow volume and spatial distribution. The water quality parameters that were measured include total settleable solids, total suspended solids, BOD_5, total nitrogen, total phosphorus, and fecal coliform bacteria. The system-wide average event mean concentrations (EMCs) for all storm events were calculated by determining the arithmetic average EMC for each parameter.

Water quality monitoring was also conducted at sample sites along the east, west, and center tracts of the Susquehanna River during three wet weather events in 2004 to determine the effect of CSO discharges on water quality. The water quality parameters that were measured include fecal coliform, dissolved oxygen, pH, temperature and turbidity.

[17] Capital Region Water, Combined Sewer System Characterization Report, Version 2.0, March 2017, available at **https://capitalregionwater.com/cbh2o/**.

Additional sampling data to measure fecal coliform along the Susquehanna River was collected by PA-DEP between July and September 2014. Sampling locations included sites that were upstream and downstream of Harrisburg mostly adjacent to developed suburban neighborhoods, as well as six locations along the reach impacted by CRW's CSO discharges. The system-wide average event mean concentrations for all storm events were calculated by determining the arithmetic average EMC for each sampling parameter.

The results from the receiving water sampling events, and the subsequent water quality analyses, are summarized in a series of tables provided in Section 4.2.3 of the March 2017, *Combined Sewer System Characterization Report.* The results include sampling dates, the number of samples taken, fecal coliform concentrations, and calculated EMCs for selected water quality parameters.

A 2016 PA-DEP assessment of the Susquehanna River concluded that due to the shallow and wide physical characteristics of the river, tributary waters have limited opportunity to mix with the volume of river water that originates upriver. In the vicinity of Harrisburg, the PA-DEP study concluded that the river is divided into five distinct flow streams with water quality differences across the total river transect. **Figure 4-11** shows the five flow streams at Rockville, PA, located approximately one mile above Harrisburg. The 2016 PA-DEP integrated report indicates that CSO discharges from CRW regulators would tend to be shore-hugging plumes.

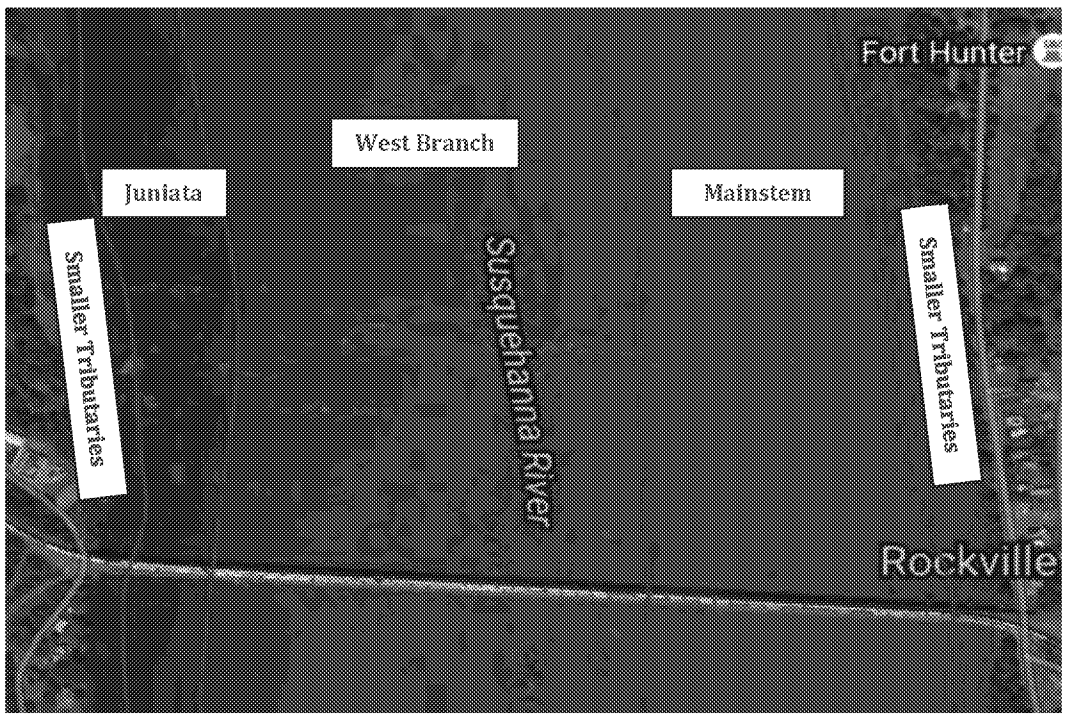

Figure 4-11: Susquehanna River Flow Streams in the Vicinity of Rockville, PA

4.6.4.2 Paxton Creek Sampling and Studies

Similar to CSO monitoring for locations along the Susquehanna River, four CSO outfalls discharging into Paxton Creek were monitored as part of CRW's 2005 Long Term Control Plan

flow monitoring program. Sampling along Paxton Creek was conducted concurrently with sampling along the Susquehanna River, for CSO discharges during the same wet weather events between June and November 2003. The sampling analysis results were used to determine the combined sewer wastewater characteristics. The parameters measured include total settleable solids, total suspended solids, BOD_5, total nitrogen, total phosphorus, and fecal coliform bacteria. The system-wide average EMCs for each sampling parameter for all storm events were calculated.

4.6.5 Pollutants of Concern

Table 4-15 identifies the pollutants of concern associated with discharges from CRW's sewer systems to the Susquehanna River, Spring Creek, and Paxton Creek. These pollutants were identified based on the various water quality/stream attainability studies by PA-DEP and others, and from prior available water quality monitoring and modeling information. Further information is provided in the December 23, 2014 memorandum *LTCP Approach*.[18]

Sediment is identified as a pollutant of concern in Paxton Creek, Chesapeake Bay, and an unnamed Tributary of Spring Creek, but not the Susquehanna River. The 2008 Paxton Creek TMDL Report indicates that about 86 percent of the sediment concentration is attributed to stream erosion and the rest to wet weather discharges.

Table 4-15: Pollutants of Concern Discharging from CRW's Combined Sewer System

Pollutant of Concern	Susquehanna River	Paxton Creek	Unnamed Trib., Spring Creek	Chesapeake Bay
Sediment		✓	✓	✓
Bacteria	✓	✓		
Dissolved Oxygen / BOD		✓		
Nitrogen / Phosphorus			✓	✓

Bacteria is a pollutant of concern in Paxton Creek and the Susquehanna due to potential human health risks from pathogens during in-stream recreational activities. Elevated levels of bacteria are associated with CSO discharges and present a potential threat in areas of the Susquehanna used for recreation. No recreation occurs in Paxton Creek at this time.

Oxygen-demanding substances (e.g., BOD, COD) that cause dissolved oxygen concentrations to fall below limits necessary to sustain aquatic life are considered a pollutant of concern in Paxton Creek. Per PADEP's 2012 Susquehanna River Study, which included water quality monitoring between June and August 2012, dissolved oxygen concentrations along the east transect of the Susquehanna were less variable. This would indicate lower discharges of oxygen-demanding substances and/or higher aeration rates, and/or greater assimilation capacity of the receiving water, resulting in few observed in-stream DO depletion events. The Paxton Creek TMDL states, however, that DO depletion is an issue in Paxton Creek related to discharge of oxygen demanding substances in CRW's CSOs.

Nitrogen and phosphorus loads must be reduced under the Pennsylvania Chesapeake Watershed Implementation Plan, and to meet PA-DEP's pollution reduction requirements for an unnamed

[18] CDM Smith, Technical Memorandum, *LTCP Approach*, December 2014.

tributary to Spring Creek. As a result, nutrients should be considered pollutants of concern for wet weather discharges to each receiving water body. Existing levels of wet weather treatment achieved by CRW's combined sewer system, coupled with additional treatment achieved under the LTCP, will help achieve the targeted nitrogen load reduction of approximately 50 percent and the targeted phosphorus load reduction of approximately 40 percent. PADEP's May 2016 NDPES General Permit for Stormwater Discharges from small MS4s establishes minimum loading reductions of Chesapeake Bay pollutants of concern–10 percent for sediment, 5 percent for total nitrogen, and 3 percent for total phosphorus.

4.6.6 Priority and Sensitive Areas

Due to the distribution of the 58 CRW outfalls (2 CSO regulators share a common outfall) along the receiving waters and the relatively uniform characteristics of the receiving waters, there are not any Sensitive Areas as defined in the National CSO Policy in the receiving waters that would directly require more attention than others in evaluating LTCP options. Portions of the Susquehanna River are used for recreation, including fishing, boating, and swimming/wading. However, it should be noted that the primary points of direct contact (swimming and wading) within the Susquehanna River are located on City Island at the public beach, which is not susceptible to discharges from CRW's CSO outfalls due to the Susquehanna River's flow regime. Near-shore discharges to the Susquehanna do not migrate or disperse from the shore, as noted in the *2016 Pennsylvania Integrated Water Quality and Assessment Report, "...this results in five distinct water columns from the east to west shores in the Susquehanna River around Harrisburg, PA. These waters do not mix due to the Susquehanna River being relatively low and shallow."* Additional information is documented in the April 1, 2016 memorandum *Sensitive Areas/Priority Areas in the Harrisburg Receiving Waters*.

4.7 Regulatory Compliance Framework

This section summarizes the various regulatory obligations applicable to entities discharging to receiving waters of the Commonwealth, providing a framework for either demonstrating that the Program Plan is able to achieve compliance with these obligations or supporting a re-assessment of water quality objectives.

4.7.1 Framework for Structural/Operational Deficiencies and Debris Buildup

CRW's partial Consent Decree recognizes the significant remedial measures necessary to restore the operational integrity of the existing AWTF, conveyance system, and collection system after years of deferred maintenance. Paragraph 11(a)(iv) requires *"a program to evaluate the structural integrity and maintenance needs of the Conveyance and Collection Systems through internal inspections utilizing state of the industry technology.* Paragraph 11(a)(vii) further requires *"a program to identify and prioritize remedial work determined based on the findings of internal and visual inspections",* while Paragraph 11(a)(viii) requires *"a list that identifies and prioritizes equipment purchases for critical equipment".* This requirement supports CRW recommendations of priority remedial repairs and equipment upgrades for its AWTF and its two major pumping stations. The failure of any of these systems presents a heightened risk of major failures at this critical infrastructure, potentially leading to significant water quality and public health risks. The PCD considered these remedial cleaning and repair needs of such high priority that Paragraph 31 identified certain projects as early action projects: